July 7.

The President, Dr. Ruschenberger, in the chair.

Fifteen members present.

The death of Dr. Governeur Emerson was announced.

Prof. Persifor Frazer, Jr., made the following remarks:—

I had the honor, at the last meeting, of presenting to the Academy for its consideration, some attempts to reconcile the results of the analyses of minerals by the best chemists with formulas, which were constructed on the doctrine of quantivalence, *i. e.*, the known atom-saturating power of the elements. In my former communication I endeavored to show that such a mixture of definite chemical compounds (generally crystallizing in different systems) as was indicated by the greater number of the old formulas could not have those characteristic physical properties which serve to distinguish homogeneous bodies from each other; and above all, that no mixture of two minerals crystallizing in different systems could produce a third crystallizing in still another system. I stated that there seemed to be only two cases in which the formation of minerals in this way is possible; the one where one of the compounds preponderates to such an extent that the resulting mass is moulded according to its own morphological law; and the other where the resulting mass is not crystallized at all, but at most crystalline, *i. e.*, made up of minute crystals or individuals of each species, but simply aggregated together.

That such is the explanation of many crystalline and crypto-crystalline rocks the microscope has sufficiently demonstrated, and it would hardly be going too far to say, that, wherever an amorphous mineral shows such a chemical constitution that its elements cannot be brought into a single formula consistent with what we already know of the behavior of its anion and cathion radicals, a strong probability exists that the mineral is simply a mixture.

On this hypothesis of the case the circumstance cannot fail to demand explanation that the same mixtures in the same proportions should so often occur with similar paragenesis; and it is not to be denied that this fact needs careful study.

But in many instances the cause of this uniformity, itself apparently the result of chance, is to be traced to disintegration of a previously existing mineral into two or more others, or the partial alteration of one mineral into another throughout its whole mass, and by the action of outside forces.

Thus chalcopyrite might suffer partial decomposition into chalcocite and pyrite, or into tenorite and hematite, or into all four of these minerals, and while the mass could have no crystal form of its own, the mutual ratios of the resulting compounds would be more constant as the process of decomposition was more perfect.

It often results that in calculating a formula for a so-called species the results of analyses of specimens from widely distant localities, and made by different persons, agree remarkably well together, while the atomic ratio is such as to resist all efforts to bring these atoms into one homogeneous compound Often, too, the student sees clearly that he is dealing with a partially decomposed mass, and would, perhaps, be justified in writing "*a*, per cent. of the mineral A with *b*, per cent. of the mineral B disseminated through it," but it is obvious that he must assign wide limits to *a* and *b*; and if the species possess that patent of genuineness, crystal form, unless he define those limits his formula loses its value.

Take the case of smaltite. This mineral has very well-marked physical properties and unmistakable crystal form, and is an arsenate of cobalt, iron, and nickel, but its per cent. of As varies from 59 per cent. (Salvetal & Wertheim) to about 75 per cent. (Karsten); the Co from 0 per cent. (Rammelsberg) to 20 per cent. (Stromeyer); the Ni from 0 per cent. (Varrentrapp & Stromeyer) to 29.50 (Rammelsberg); the Fe from trace (Rammelsberg) to 18 (von Kobell); Cu from 0 per cent. (Lange, Booth, Karsten, &c.) to 2 per cent. (Jäckel). Besides these very large varieties of composition there are frequently found other elements with it, such as Bi and S. How is a formula to be constructed for such a mineral?

The only recourse is to the R's, and we have no less than four groups of formulas proposed by Dana, under one of which every smaltite yet analyzed can be brought. The first two of these are really identical, and differ only in the different proportions in which the analogous elements Ni, Co, and Fe, replace each other, and may be written RAs_2. But the next group (C) has the formula $RAs + RAs_2$, and the third (D) $RAs_2 + RAs_3$.

Independently of the presumptive evidence against such a mixture producing a beautiful octahedron of smaltite, where is to be the limit to such formulas? Why not $RAs + RAs_2 + RAs_3 +$ etc.? And would it not be well to adopt some more definite rule for assigning formulas to minerals of such variable composition?

Without naming these laws certain facts can be assumed on which to base them: 1st. If there is no single chemical formula which expresses the constitution of a crystallized mineral, then that mineral is a mixture. 2d. Its form is determined by the preponderance in quantity or in crystallizing power, or both, of *one* of its constituents. 3d. The mineral can only present its characteristics when the foreign ingredients are present under a given per cent.

The plan would seem to be to deduce from the known characteristics of the simpler compounds which most resemble it, to which of them it owed its morphological properties; and, having decided this question, to write the formula for that mineral as the species, and consider the other as a complex variety of it.

I append some few names of minerals with their old and new rational formulas generally compared, and in addition to the usual method of writing these new formulas I have added that form of graphic symbol which presents fewest typographical difficulties.

Old Formula.	New Formula.
Niccolite.	
$NiAs$	$Ni^{II}=As^{I}-As^{I}=Ni^{II}$ or } (?)
Ni_3As_3	$Ni^{IV}\equiv As^{V}-As^{V}\equiv Ni^{IV}$ or }
	$As^{III}\equiv Ni^{IV}-Ni^{IV}\equiv As^{III}$
	$(Ni_2)^{VI}As_2^{III}$
Breithauptite.	
$NiSb$	$(Ni_2)^{VI}Sb_2^{III}$
Ni_3Sb_3	
Bornite.	
$(Cu_2,Fe)S$	$(Cu_2)_3^{II}\equiv S_6^{II}\equiv(Fe_2)^{IV}$
	$(Cu_2)_3^{II}Fe_2^{VI}S_6$
	(Recalculated from one of the original records of analysis.)
Chalcopyrite.	
$Cu_2S+FeS+FeS_2$ (D)	$(Cu_2)^{II}=S_2^{II}=Fe_2^{VI}\equiv S_2^{II}$
usually $Cu_2S+Fe_2S_3$	$(Cu_2)^{II}Fe_2^{VI}S_4$
Barnhardite.	
$2CuS+FeS+FeS_2$	$(Cu_2)_2^{II}\equiv S_4^{II}\equiv Fe_2^{VI}=S$
	$(Cu_2)_2Fe_2S_5$
Calaverite.	
Au_2Te_4	$Te^{II}=Au^{III}-Te^{II}-Te^{II}-$
	$-Au^{III}=Te^{II}$
	$Au^{III}Te_2^{II}-Te_2^{II}Au^{III}$
	$(Au^{III}Te_2^{II})_2$
Miargyrite.	
$Ag_2S+Sb_2S_3$	$Ag^{I}-S^{II}-Sb^{III}=S^{II}$
	$Ag^{I}Sb^{III}S_2^{II}$

Old Formula.	New Formula.

(Antimonial.) Tetrahedrite.

$4CuS+Sb_2S_3$

$$\begin{array}{ccccccccc}(Cu_2)^{II}=S_2^{II}=&Sb^{V}&-S^{II}-&Sb^{V}&=S_2^{II}=(Cu_2)^{II}\\ &\|&&\|&\\ &S^{II}&&S^{II}&\end{array}$$

$$(Cu_2)_2^{II}Sb_2S_7$$

(Arsenical.) Tetrahedrite.

$4CuS+As_2S_3$

$$\begin{array}{ccccccccc}(Cu_2)^{II}=S_2^{II}=&As^{V}&-S^{II}-&As^{V}&=S_2^{II}=(Cu_2)^{II}\\ &\|&&\|&\\ &S^{II}&&S^{II}&\end{array}$$

$$(Cu_2)_2^{II}As_2S_7$$

Wittichenite.

$3Cu_3S+Bi_3S_3$

$$S^{II}=Bi^{III}-S^{II}-(Cu_2)_2^{II}=$$
$$=S_3^{II}=Bi^{III}$$
$$(Cu_2)_2^{II}Bi_2^{III}S_5^{II}$$

Note.—Dana gives the atomic ratio of Cu : Bi : S : : 3 : 1 : 3. From his seventh record of analysis (by Schneider), however, this ratio is 4 : 2 : 5.

Stromeyerite.

$(Ag,Cu_2)S$

$$(Cu_2)^{II}=S_2^{II}=Ag_2^{I}$$
$$((Cu_2)^{II}Ag_2^{I})S_2^{II}$$

Note.—The atomic ratio expressed in Dana's formula is Ag : Cu : S : : 1 : 2 : 1, whereas from Stromeyer's analysis it appears very clearly as 1 : 1 : 1.

Dufrenite.

Karsten's Analysis D2.

$Fe_2O_3.PO_5+3HO$

$$\left.\begin{array}{l}O^{II}=Fe_2^{VI}\equiv O_3^{II}\equiv P^{V}=O^{II}\\ \qquad\ \ |\\ \qquad O^{II}\\ \qquad\ \ |\\ O^{II}=Fe_2^{VI}\equiv O_3^{II}\equiv P^{V}=O^{II}\end{array}\right\}+(H_2O)_5$$

$$(((Fe_2)_2^{VI}O_3)(P^{II}O_4^{II})_2^{III})_2+(H_2O)_5$$

Libethenite.

$4CuO.PO_5+HO$

From the atomic ratio.

Cu : P : H : O : : 2 : 1 : 1 : 5

$$Cu_2^{II}\equiv{}^{I}O_4\equiv P^{V}-O^{II}-H^{I}$$
$$(HCu_2^{II})(P^{V}O_5^{II})^{V}$$

Olivenite.

$4CuO.(P,As)O_5+H_2O$

$$((H^{I}Cu_2^{II})As^{V}O_5^{II})_2$$
$$Cu_2^{II}\equiv O_4\equiv As^{V}-O^{II}-H^{I}$$

Note.—Some P replaces As.

Old Formula.	New Formula.
Malachite.	
$2CuO.CO_2$	$Cu_2^{II} \equiv O_4^{II} \equiv C^{IV} + aq$
Domeykite.	
$(Cu_2)_3As_2$	$As^{III} \equiv (Cu_2)_3^{II} \equiv As^{III}$ $(Cu_2)_3^{II}As_2^{III}$
Dyscrasite.	
Ag_2Sb	$Sb^{V} \equiv Ag_5$ Calculated from original record of analysis by Rammelsberg (No. 9 in Dana).
Leucopyrite.	
$FeAs_2$	$As^{I} - Fe^{II} - As^{I}$ $Fe^{II}As_2^{I}$
Linnæite.	
$2CoS + CoS_2$	$Co^{II} = S_2^{II} = Co^{IV} = S_2^{II} = Co^{II}$ $Co_3S_4^{II}$
Skutterudite.	
$CoAs_3$	$As_3^{I} \equiv Co^{IV} - Co^{IV} \equiv As_3^{I}$ $(Co_2)^{VI}As_6^{I}$
Sylvanite.	
$(Ag,Au)Te_3$	$Ag^{I}Te^{II} - Au^{III} = Te^{II}$ $(Ag^{I}Au^{III})Te_2^{II}$
Jamesonite.	
$2(Pb,Fe)S + Sb_2S_3$	$Pb^{II} = S_2^{II} = Sb^{III} - S^{II} - Pb^{II} -$ $- S^{II} - Sb^{III} = S^{II}$ with Fe replacing Pb, or $Pb_2^{II}Sb_2^{III}S_5^{II}$
Chalcostibite.	
$Cu_2S + Sb_2S_3$	$(Cu_2)^{II} = S_3^{II} = Sb_2^{III} \equiv S_2^{II}$ $(Cu_2)^{II}(Sb^{III}S_2^{II})_3^{I}$
Bournonite.	
$3(Cu_2,Pb)S + Sb_2S_5$	$Sb^{III} \equiv S_3^{II} \equiv Pb_2^{II} - S^{II} - Sb^{III} =$ $= S_2^{II} = (Cu_2)^{II}$ $(Pb_2^{II}(Cu_2)^{II})(Sb^{III}S_3^{II})_2^{III}$

Old Formula.	New Formula.

Stephanite.

$5AgS + Sb_2S_3$ $Ag_5^{I} \equiv S_5^{II} \equiv Sb^{V}$

$Ag_5^{I}Sb^{V}S_5^{II}$

Note—Dana's first record of analysis by H. Rose gives atomic ratio of Sb : S : Ag : : 1 : 4.2 : 5.2, but the indications are of a compound as above.

Sartorite.

$PbS + Sb_2S_3$ $Pb^{II} = S_2^{II} = Sb_2^{III} \equiv S_2^{II}$

$Pb^{II}(Sb^{III}S_2^{II})_2$

Brochantite.

From Forchhammer's Analysis (D 3).

$(3CuO.SO_3)_2 + CuO.HO$ The ratio of

Cu : O : S : H : : 3 : 9 : 1 : 6

hence

$Cu_2^{II} = O_4^{II} \equiv S^{VI} = O_2^{II} = Cu^{II} +$

$+ aq$

hence $Cu_3^{II}S^{VI}O_6^{II} + (H_2O)_3$

Change of Habit in Smilacina bifolia.—Mr. THOMAS MEEHAN remarked that this plant, as was well known, was usually terrestrial, preferring generally the vicinity of large trees. It propagates itself by underground stolons, advancing but a few inches each season; the stolons of the preceding year dying as soon as a new one was made. He had recently seen a case where the stolons had advanced from the ground, and up the trunk of a large chestnut tree, to the height of about two feet; the original stolons for several years back having died away, and the plant taken in a purely epiphytal character. The roots and stolons mostly had penetrated the coarse, rough bark of the chestnut tree, the leaves only being chiefly visible. The fact is trifling, and in old times, perhaps, hardly worth recording; but in these days, when the change of character in connection with the evolution of form had such a general interest, even this was worth recording.

JULY 14.

The President, Dr. RUSCHENBERGER, in the chair.

Seven members present.

The following papers were presented for publication:—

"On Fertilization of certain Flowers through Insect Agency, and other Matters Botanical." By Thos. G. Gentry.